leges for the instruction of boys, on the other. They are, indeed, developing toward true universities, but nothing could better hasten and direct this development than a national university.

From a theoretical point of view it would seem that all the arguments which have been urged against the establishment of a national university turn out to be in its favor. The cost, the incompetence of government and the claim that existing universities suffice are, however, practical difficulties which we do not underestimate. Indeed, these are so evident that we should regard it as useless to advocate the immediate establishment of a great national university. We rather hope for a gradual growth from the national institutions already existing at Washington.

We have there great libraries, museums and laboratories, able investigators engaged in advancing pure and applied science, and younger men learning from them the methods of research. These are the essentials of a university. No university in the world includes so many or such able investigators, teachers and students of geology as the U. S. Geological Survey, and in many departments the work at Washington surpasses any American university in the amount of investigation accomplished and in the number of investigators trained.

We should recommend the development of the Bureau of Education somewhat in the direction of the University of the State of New York. Let it have power to regulate academic degrees and to confer them. Degrees may belong to an immature civilization, but this is just the kind of civilization of which we must make the best. Workers in the different government divisions and others having the proper preliminary education could, on presenting a thesis showing original work and passing an examination, receive the doctorate of philosophy, and this would qualify them as a civil service examination for promotion. The present Commissioner of Education, and perhaps the regents of the Smithsonian Institution, could govern the university. Examiners could be appointed from leading representatives of science and learning who would meet yearly for a week of convocation in Washington. We believe that, without radical changes and with nominal expense, there could be established at Washington a national university likely to become the world's greatest university.

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*SCIENCE AND PSEUDO-SCIENCE IN MEDICINE.**

ONE of the definitions given by Webster for the term 'science' is: "Truth ascertained; that which is known. Hence, specifically, knowledge duly arranged, and referred to general truths and principles upon which it is founded and from which it is derived; a branch of learning considered as having a certain completeness." Having this definition in view I think we are justified in speaking of medicine as a science. No doubt it is incomplete in many directions, but by the application of scientific methods of research such rapid progress has been made during the past fifty years that to-day medicine stands upon a substantial basis of 'truth ascertained' in all of its departments, and when we consider the breadth of the field covered by these various departments the lacunæ, in our knowledge, are no greater than in many other

*Read before the Anthropological Society of Washington, December 15, 1896.

branches of science, *e. g.*, in physics or in geology.

Evidently scientific medicine must be founded upon an exact knowledge of the structure (anatomy) and functions (physiology) of the human body in a healthy condition and of the changes in structure and function (pathology) which result from various disease processes; of the causes (etiology) natural history (clinical medicine) and regional distribution (medical geography) of the diseases which afflict mankind and the lower animals (comparative pathology); of the toxic action of various substances from the animal and vegetable kingdom (toxicology) and of the use of these and of other nontoxic substances, physical agents, etc., in the treatment of disease (therapeutics). For the illiterate and even for many of the so-called educated class the whole of medicine consists in the cure of disease by medicines, or by some agency, natural or supernatural, and a failure to cure is evidence that medicine is not a science. We readily admit that the cure of disease is one of the principal objects which medical science has in view and that from a scientific standpoint therapeutics is very much behind some of the other branches of medicine. This is shown by the diversity of remedies prescribed for certain diseases and the failure of any one of these remedies to effect a cure in many cases. But, on the other hand, therapeutics has made great advances during recent years and by the application of scientific methods of research the exact value of alleged remedies and of various methods of treatment is now determined with far greater precision than formerly.

A few years ago the intelligent and honest physician did not claim to have any considerable number of specific remedies at his command; but his scientific knowledge relating to the cause, symptoms and pathology of disease enabled him to conduct many cases to a successful termination which without his assistance would have proved fatal. By the use of scientific instruments and methods of investigation he was able to make an early diagnosis and to give advice which might stay the progress of a disease which in its more advanced stages it would have been beyond his skill to arrest. Recently several additions have been made to the list of specific therapeutic agents and there is good reason to believe that further discoveries in this direction will be made as a result of investigations now being conducted in pathological laboratories in various parts of the world. Among the most important recent discoveries in this department of scientific medicine we may mention the use of thyroid extract for the cure of myxœdema, the antitoxin of diphtheria and the antitoxin of tetanus. The wonderful triumphs of modern surgery, the scientific precision of the methods employed by the skilled ophthalmologist and the achievements of the scientific obstetrician can only be referred to *en passant* in support of the statement that we are today justified in speaking of medicine as a science.

While, as we have said, the cure of disease is one of the principal objects which medical science has in view, this is by no means the sole object. Sanitary science is a branch of medicine based upon chemical and physiological knowledge which has been gained by the painstaking researches of a host of investigators who have determined the constituent elements of the air we breathe, the water we drink, the food we eat, and the nature of the harmful impurities which are found in these; it teaches us the difference between healthful indulgence in food, exercise, mental activity, etc., and those excesses which lower the vital resisting power and establish a predisposition to disease. Preventive medicine, which is a broader term, if we regard the beneficent

results accomplished, must be placed in advance of therapeutics. Where thousands have been saved by the timely administration of suitable medicines, or by the skillfully performed operation of the surgeon, tens of thousands have been saved by preventive medicine. And preventive medicine is to-day established upon a strictly scientific foundation. If our practice was *pari passu* with our knowledge infectious diseases should be almost unknown in civilized countries and those degenerative changes of vital organs which result from excesses of various kinds would cease to play a leading part in our mortuary statistics. But while our knowledge is still incomplete in some directions, and while individuals and communities constantly fail to act in accordance with the well-established laws of health and the scientific data which furnish the basis of preventive medicine, the saving of life directly traceable to this knowledge is enormous.

Small-pox no longer claims its victims in any considerable numbers except in communities where vaccination is neglected; the last extended yellow fever epidemic in the United States occurred nearly twenty years ago; cholera has been excluded from our country during the last two widespread epidemics in Europe and its ravages have been greatly restricted in all civilized countries into which it has been introduced; the deadly plague of the 17th and 18th centuries is no longer known in Europe, and the prevalence of typhus (so-called 'spotted' or 'ship fever') has been greately limited. Typhoid fever, tuberculosis and diphtheria are still with us and claim numerous victims, but we know the specific cause of each of these diseases; we know where to find the bacteria which cause them and the channels by which they gain access to the human body; we know how to destroy them by the use of disinfecting agents ('antiseptics'); and in the case of diphtheria we have recently discovered a specific mode of treatment which when promptly applied reduces the mortality from this dread disease to a comparatively small figure.

The brilliant success which has attended the carrying out of modern antiseptic and aseptic methods in surgical and obstetrical practice are too well known to call for extended remark.

Sir Edwin Arnold in an address delivered in 1895 at St. Thomas' Hospital, upon 'Medicine, its past and future,' says:

"One of the high authorities already quoted has furnished a calculation of the salvage of life effected even during the early years of the present reign by the commencing improvements in preventive and curative medicine. In the five years from 1838 to 1842, London with an average population of 1,840,-865 persons, had an average annual mortality of 2,557 in every 100,000. In the five years from 1880 to 1884 the average metropolitan population was 3,894,261, and the average annual death-rate 2,101 in each 100,-000. A calculation will show that these figures represent a saving or prolonging of lives during that lustrum to the number of 96,640. The mean annual death-rate has now been reduced to a point lower than shown in these figures. It was 22.16 per 1,000 for England and Wales at the commencement of the reign, and it is to-day better than 19.0 per 1,000, while in Her Majesty's army and navy the diminution of mortality apart from deaths from warfare has proved even more remarkable, and in India, where we used to lose 69 per 1,000 yearly, this has been reduced to 16 per 1,000."

Having thus briefly referred to the present status of scientific medicine I shall devote the remainder of my time to a consideration of the second theme included in the title of this paper, viz.: Pseudo-science in medicine.

History shows us that the development of each branch of science has been accompanied by unfounded inferences, based upon partial knowledge, which have been abandoned by the learned as the science has become established upon a basis of ascertained facts, but which have continued to pass current among the ignorant, often

for centuries after they have been abandoned by the well-informed. Thus, astrology, alchemy, phrenology, homeopathy and 'Christian Science' have met with acceptance not only by the ignorant, but by many of the so-called educated class. As a matter of fact, a scholastic and classical education does not greatly aid in the differentiation between science and pseudo-science; and at the present day many persons who belong to the 'educated class' and even to the learned professions are led astray by claims made upon what appears to them to be a scientific basis. Unless the spirit of scientific scepticism, which demands absolute demonstration before final acceptance, has been cultivated by special training, there is always a liability to be misled by the specious claims of pseudo-scientific pretenders, or of the still more dangerous charlatans who believe in themselves and their pseudo-discoveries. And even among those who have had a more or less complete scientific training it often happens that there is a natural tendency to generalize from insufficient data and to jump at conclusions in advance of the experimental evidence which alone could justify them. Such men are even more dangerous in the ranks of scientific workers than they would be as theorists who ignored the value of scientific research; and many pseudo-scientific discoveries which have passed current for a time, and the refutation of which has been held to show the uncertainty of scientific deductions, have been made by men of this class, whose mental characteristics entirely unfit them for scientific research.

Hand in hand with the progress of medical science we see an army of pseudo-scientific quacks who trade upon the imperfect knowledge of the masses, and by plausibly written advertisements convince many, even of the educated classes, that their particular method of treatment is based upon the latest scientific discoveries. A Priestley discovers oxygen; the physiologists show that this gas is essential to life and that the maintenance of a full degree of vital activity depends upon the possession of healthy lungs of ample capacity and the respiration of pure air; the scientific physician discovers defects in the respiratory apparatus and under certain circumstances prescribes oxygen for the relief of symptoms resulting from a deficient supply of this life-sustaining gas. But the pseudo-scientist extols oxygen as a cure-all for pulmonary complaints, or invents an apparatus which may be held in the hand or carried in the pocket, by which oxygen will be absorbed in some mysterious way, and without difficulty obtains numerous certificates as to the marvelous cures effected by his method. A Franklin draws lightning from the clouds; a Galvani shows that an electric current may be developed by the contact of metals and that such a current causes muscular contraction; and innumerable patient investigators add to our knowledge of electricity. The scientific physician avails himself of this potent agent for the treatment of certain ailments in which it appears to be indicated, but admits that he meets with many disappointments in his clinical experiments. The pseudo-scientific quack writes, or has written, advertisements in which fact and fiction are so commingled that even educated persons may be deceived, and having aroused interest in the alleged therapeutic value of this mysterious agent, offers his electric belt, or finger ring made of two metals, or pocket battery, as a sure cure for certain specified ailments, or, if less modest and more certain of the credulity of the public, as a cure for all of the diseases to which man is subject.

Again, a Pasteur proves that the disease of sheep and cattle known as anthrax is due to a microscopic organism found in

the blood; an Obermeyer discovers a different microorganism in the blood of relapsing fever patients, and numerous patient workers in laboratories rapidly add to our knowledge of pathogenic bacteria. Then comes the man with the microbe killer. He tells you that all diseases are due to germs in the blood and that his fluid kills them without fail. Science has demonstrated that comparatively few of the infectious diseases of man are due to the presence of pathogenic bacteria in the blood, and that the microbe killer has comparatively little germicidal value; but a credulous public accepts the interested statements which appear to have a scientific basis, and swallows the microbe killer with impunity, if not with benefit. And so it goes. Science establishes the value of thyroid extract for the cure of myxedema, and immediately the public are called upon to swallow extracts of brain for cerebral trouble, of heart for cardiac disease, etc. Even the Chinese pulse-doctors obtain a large clientele on the Pacific coast. Their solemn looks and pretentious claims impose upon the ignorant, and it is said that educated people not infrequently consult them.

One of the most successful pseudo-scientific quacks of the present day has written a book in which he gives a history of the alleged discovery of his cure-all and from which I desire to make two or three quotations. One of these shows the author to have been a close observer of the genus homo. He says:

"People should not be led away by every charlatan who jumps up before them and talks; but as long as the world lasts there will probably be fools in it, and fools are a godsend to rogues. There is a fascination in being humbugged. Make it known to the world that you are going to do some impossible thing, and the world will pay money to come in and see you do it, although well understanding all the while that the thing cannot be done."

The financial success of 'the microbe killer' indicates that the discoverer of this alleged cure-all has substantial proof of the truth of the frank statements above quoted. The author's personal experience with microbes is given on another page as follows:

"When I drove to my seed store I knew that I could sit only on the edge of my buggy, because the microbes would not let me sit in any other way, and when I stepped to the ground I knew that it took me several minutes before I could move, the microbes that produced sciatica and rheumatism objecting to being disturbed, and so preventing me. Every attempt to move had to be slow and deliberate, until they should get accustomed to the change. I was a living barometer. Whenever the weather altered, and especially if it became cooler, my collection of microbes could anticipate it two or three days, and when the storm came they would freeze and force me to take refuge by a red-hot stove to get them quieted."

On another page the author states his theory with reference to disease and its treatment as follows: "But I knew that his symptoms were of secondary importance. They were interesting to have, but not essential, because all disease is due to the same cause and requires but one cure." Of course that one cure is the microbe killer and you must beware of imitations. The author describes his unsuccessful attempt to obtain relief from the advertising quacks, as follows:

"Good friends were generous with their advice. I was told to try first one thing then another, but I had become wearied with what I had come to believe was so much humbug, and I determined to swallow no more medicine. I again studied advertisements. There I saw commended electric belts, porous plasters, liniments, lotions and salves, and all sorts of external applications that would cure everything, purify the blood, strengthen the nerves, stimulate the functions of the organs, kill the microbes, and rejuvenate the individual in mind and body. Well, this was something. Whatever such things would or would not do, there was no medicine in them—nothing to swallow, no poison, so, if they did no good, I could not see that they would do harm. The end of my thinking was that I sent off ten dollars to Chicago for an electric belt. Some of the advertising firms fail to respond, as they promise, to money remittances, but my belt came, and I lost no time in fixing it on. It reminded me of former days when I was a soldier, with belt and sabre, in the German

army. Then I jumped ditches eight feet wide, and sang and laughed when others fell into the water, but now things were changed. Then I had health and youth, now I was far older in health than in years, but I concluded that, being but forty-three, if the belt did all that was promised for it, there should be no reason why I might not live forty years or more yet. So I gave the belt a good chance. I wore it faithfully for three months, and tried to help it by covering myself in every likely spot with porous plasters. In that condition I went about my business, clad in a kind of coat armor to fight microbes. I tried to persuade myself that I was doing exactly the right thing, and set to work to find enjoyment among my roses and to forget my troubles.

"But it was of no use. My limbs did not consider that much enjoyment. The microbes were unhappy, and would not be appeased. They gave me no rest; they tortured me unceasingly, and finally they drove me back in despair and desperation to my bed."

These unhappy microbes were finally appeased or destroyed by the 'microbe killer,' and having generously determined to allow his fellow-men to share in the benefits of his wonderful discovery the Texas seedsman soon became rich and famous. His book is illustrated by photomicrographs which are supposed to show the microbes of various diseases. The writer is unable to recognize any known disease germ in these photomicrographs, some of which show, more or less distinctly, epithelial cells, granular débris of the various tissues, yeast cells, pencillium spores, etc.

Another pseudo-scientific 'discovery' which is largely advertised in the monthly journals is the 'Electropoise,' which is described as 'a little instrument which enables the system to take on oxygen freely from the atmosphere. This addition of nature's own tonic increases vitality, tones up the nervous system, purifies the blood, and by expelling the morbid matter and diseased tissues restores the body to its normal condition—health.' The *modus operandi* of this wonderful instrument is more fully explained in the following published certificate (advertisement in *McClure's Magazine*):

"We are slow to commend new discoveries of any kind, for the reason that so many of them prove to be worthless. But we commend the 'Electropoise' as a safe and effective health restorer. We do not pretend to explain the philosophy of its workings, but having realized its beneficial effects we can speak of its results. One might conclude, from its name, that it was an electric battery. But it does not generate electricity and is in no sense a battery, belt, sole, or anything kindred to them. It consists of a small cylinder called a 'polarizer,' which is used in connection with the patient's body by means of a common electric cord. This polarizer causes oxygen from the atmosphere to be absorbed by the entire surface of the body with great rapidity, the strength of the absorption being regulated according to the ability of the patient to receive.

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"After a year's use we have this to say in its favor: (1) We have taken no medicine for the year. (2) All traces of la grippe and an old sunstroke trouble have disappeared and no symptoms of either remain. Once or twice, from severe overwork, we have found it necessary to hold up for a few days, but in no time for fifteen years have we been better than during the past year. Much of this we attribute to the use of the 'Electropoise.'

"This notice of the 'Electropoise' is without solicitation and entirely gratuitous. We do it for the good of the afflicted. We have no personal interest in it and are not paid for what we say in its favor. Persons desiring further information can address the agent."—Rev. Wm. McDonald in *Boston Christian Witness.*

We would suggest to the Rev. Wm. McDonald that he try the following simple experiment: Having connected the 'polarizer' with his leg by means of the 'common electric cord,' let him place his one hand over his mouth and nose, thus shutting off oxygen of the atmosphere from the lungs, which have been provided by nature to furnish the necessary supply of this gas. Now let him note by a watch how long the supply of oxygen 'absorbed from the entire surface of the body' will answer as a substitute for nature's method of supplying this gas. We venture also to suggest to the Rev. Wm. McDonald that 'all traces of *la grippe* and of an old sunstroke trouble' might have disappeared during

the year if he had not used the Electropoise. Assuming that this certificate is genuine, it answers very well to illustrate the fact that educated men, who have not been trained in the methods of scientific investigation, often arrive at conclusions entirely unjustified by the evidence before them by the dangerous use of the *post hoc ergo propter hoc* method of argument.

The fact that a considerable proportion of those who are sick from various acute or chronic ailments recover after a time, independently of the use of medicinal agents or methods of treatment, taken in connection with this tendency to ascribe recovery to the treatment employed, makes it an easy matter to obtain certificates of cure for any nostrum which an unprincipled money-seeker may see fit to offer to a credulous public. If ten in a thousand of those who have used the alleged remedy believe themselves to have been benefited, their certificates will answer all purposes of exploitation and the 990 will not be heard from by the general public.

As was to have been expected, the X-ray has already been made a source of revenue by more than one pseudo-scientist. The following account of the *modus operandi* of its supposed therapeutic action has recently been published in the newspapers:

"After the Crookes tube is excited by the coil the magnetic lines of force are projected down in the same manner as they pass off from a magnet, and traversing the intervening space, pass through the body down to the floor, and back to the coil and tube again, completing the circuit.

"The X-ray is electrostatic in character and of a very high potential. With every discharge from the Crookes tube oxygen is liberated in the body, as well as the surrounding atmosphere, which, combining with nascent oxygen, forms ozone.

"It is due to the electrolysis produced in the body that we are able to destroy the bacilli in contagious disease, ozone being the most powerful germicide known."

We remark, first, that we do not fully understand why 'the magnetic lines of force' are reflected back by the floor, 'completing the circuit.' Inasmuch as the X-rays pass through wood, this mysterious action of the floor appears to call for some further explanation.

We will pass by the ingenious explanation of the formation of ozone, as a result of the action of the X-ray, to call attention to the mistaken statement that ozone is 'the most powerful germicide known.'

Upon this point I take the liberty of quoting from the Manual of Bacteriology:

"The experiments of Fränkel show that the aerobic bacteria grow abundantly in the presence of pure oxygen, and some species even more so than in ordinary air.

"*Ozone*—It was formerly supposed that ozone would prove to be a most valuable agent for disinfecting purposes, but recent experiments show that it is not so active a germicide as was anticipated, and that from a practical point of view it has comparatively little value.

"Lukaschewitsch found that one gramme in the space of a cubic metre failed to kill anthrax spores in twenty-four hours. The cholera spirillum in a moist state was killed in this time by the same amount, but fifteen hours' exposure failed to destroy it. Ozone for these experiments was developed by means of electricity.

"Wyssokowicz found that the presence of ozone in a culture medium restrained the development of the anthrax bacillus, the bacillus of typhoid fever, and others tested, but concludes that this is rather due to the oxidation of bases contained in the nutrient medium than to a direct action upon the pathogenic bacteria.

"Sonntag, in his carefully conducted experiments, in which a current of ozonized air was made to pass over silk threads to which were attached anthrax spores, had an entirely negative result. The anthrax bacillus from the spleen of a mouse, and free from spores, was then tested, also with a

negative result, even after exposure to the oxonized air for twenty minutes at a time on four successive days. In another experiment several test organisms (Bacillus anthracis, Bacillus pneumoniæ of Friedlander, Staphylococcus pyogenes aureus, Staphylococcus pyogenes albus, Bacillus muriseptiicus, Bacillus crassus sputigenus) were exposed on silk threads for twenty-four hours in an atmosphere containing 4.1 milligrammes of ozone to the litre of air (0.19 volumes per cent.). The result was entirely negative. When the amount was increased to 13.53 milligrammes per litre the anthrax bacillus and Staphylococcus pyogenes albus failed to grow after twenty-four hours' exposure. The conclusion reached by Nissen, from his own experiments and a careful consideration of those previously made by others, is that ozone is of no practical value as a germicide in therapeutics or disinfection."

From a practical point of view the use of the X-ray in the practice of the Chicago doctor, to whom the above quoted explanation of its therapeutic action is attributed, appears to have been quite successful. He says:

"For the last eight months I have had patients under the X-ray in my laboratory from 9 a. m. to 6 p. m., duration of treatment varying from a-half to four hours at each treatment, and not once with any bad result in any case."

Now it is evident that a physician who has patients coming to his office from 9 a. m. to 6 p. m. every day is in the enjoyment of a very handsome professional income. And if, as I imagine, many of these patients are well-dressed ladies with more leisure than judgment, they are no doubt satisfied to pay well for the opportunity of having the latest *scientific* treatment applied to their cases and to await their turn in the anteroom of this distinguished 'professor of electro-therapeutics.'

The article from which we have quoted, and which appears to answer all the purposes of a free advertisement, concludes as follows:

"It must not be forgotten that electric phenomena are very powerful, and not every man who can buy a machine is capable of applying it. The electric machine must be as skillfully adjusted to each individual as the microscope to a specimen submitted to it. It is a treatment full of danger if ignorantly or rashly handled, but beyond price in value to the skilled and careful electro-therapeutist."

We do not propose to prejudge the question of the possible therapeutic value of the X-ray, but we think it safe to predict that it will not be found of any value for the destruction of pathogenic bacteria in the tissues, inasmuch as it has been shown by several competent observers to have very little, if any, germicidal action; and because there is no experimental evidence which justifies the belief that these low vegetable organisms can be destroyed by any physical or chemical agents which would not at the same time destroy the vitality of the less resistant cellular elements of the tissues.

If time permitted I might further illustrate the temporary successes of recent pseudo-scientific discoveries by referring to the 'cryptococous xanthogenicus' of Domingos Freire, of Brazil, the Bacillus malariæ of Klebs and Tomasi Crudelli, etc., etc.

The spectacle of a learned clergyman, supplied by nature with a brain and a pair of lungs, sitting day after day with an 'electropoise' attached to his leg for the purpose of 'taking on oxygen freely from the atmosphere' recalls the 'blue grass craze' of twenty-five years ago.

George M. Sternberg.
Washington, D. C.

THE AMERICAN PSYCHOLOGICAL ASSOCIATION.

The fifth annual meeting of the American Psychological Association was held in Boston, Tuesday and Wednesday, December